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DATA PROCESSING DIGEST

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Management Decision-making Techniques

A MANAGER APPRAISES OPERATIONS RESEARCH

R. A. Norman, General Electric Company
JOURNAL OF INDUSTRIAL ENGINEERING, May-June 1957; pages 173-181.

The title is misleading. This is actually a very good case history of a top level OR study, or as the author puts it, "Operations Synthesis." He describes synthesis as "an attempt to create an analogy of the total business or system in terms of the individual elements or functions which go to make up the total system." Operations synthesis "is directed at determining what the various functions of the system are, how they contribute to the total, how they are interrelated and interact.... defining the individual elements precisely--preferably mathematically--in terms of the total system, so that they may be evaluated and understood, and so that the probable effect of a change of the individual elements on other elements and on the total system may be gauged."

The business being studied is the cathode ray tube business, which falls into two categories: marketing of tubes for manufacturers of TV sets, and marketing of tubes for replacement use by TV repairmen. The study was made on the assumption that the business could be restructured to perform more efficiently. The initial question was "How can the same net service be performed with less work? How can the product be delivered to the customer for less cost?"

The study was to be concerned with the structure of the organization and the relationship between functions. It was found that existing accounting records were inadequate for the purpose of the study because the force that keeps the business system going is profits, and these are usually expressed in dollars. Dollar cost figures "are symbols for functions and not the actual function or work effort itself. Accounting is concerned with accumulating these symbols and combining them to represent the net effect of a series of functions. This study was concerned with isolating and differentiating between functions."

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The functions of the business were laid out in the form of a flow chart, beginning with the material elements purchased, through the manufacturing process until the goods were delivered to a customer and the money for them came back to the company. A list of fifty elements was developed, which fell into the categories, product, facility, and flow.

Three elements: product, facility, flow

"We found, as we worked through our flow chart, that we were continually working with quantity factors which, while not identical and subject to a variety of breakdown, were nevertheless all interdependent and interrelated. Actually, they were all derivatives of our output figures. By developing the proper coefficients and coupling them to certain flow characteristics, we could automatically develop the entire flow pattern for the entire system for any given output over a specific period of time."

Subsequently, a model of the business was produced, and programed for a punched card calculator.

A model of the business was constructed

"... Through the use of the model, we were able to test [the elements] individually and in combination. Finally we attempted to construct a complete new model of the business, using the same terms as we had used in our description of the existing business, but tailoring the structure so as to best suit the specific requirements of our markets. Essentially this was a 'dream' set-up. It reflected how the business could be set up to meet the existing situation and was not limited by considerations of the structure as we now know it. A detailed comparison of this with our present business not only gave us a measure of the potential of the business, but also pointed out the specific areas of weakness in our present structure."

The next step was to vary the volume requirements and market conditions for future possibilities. "Obviously, a device of this kind is not going to predict the future, nor is it going to make management decisions. It does, however, lend itself to providing information as to what might happen under a variety of future circumstances or management decisions."

General conclusions as to business models: "...it is not only a very valuable management tool, but, as our business system grows in complexity, it will become an absolute necessity. We have already reached such a degree of specialization of functional development and training that some device is sorely needed to bridge the gap between sales, engineering, manufacturing, and all the other functions; a device that will provide mutual understanding of the common purpose and the interrelationship of functions.

"Specifically, the 'systems' approach to a business...provides the following:

1. A better understanding of the business, its purpose, its functions, and its meaning....

2. An appreciation for the meaningful information in a business system as differentiated from the data in the system....

3. A mechanism for planning and controlling a business system...."

OPERATIONS RESEARCH APPLIED—NEW USES AND EXTENSIONS

Special Report No. 17, American Management Association, 1957

Among the 15 articles in this report were three which had some particularly interesting things to say.

Inventory control, forecasting, linear programing

"Optimum Decisions for Manufacturing Stores Inventory Control." by N. H. King, of Westinghouse, explores management decision-making problems, aided by numerous charts showing the characteristics of the inventory control function. The mathematical procedures described are shown to be useful for a manual procedure, as illustrated by a sample worksheet for use of the formulas.

In the article "Gearing Production to Sales Forecasts," by Walter D. Leach, Jr., of The William Carter Company, it is stated that the better customer relations, resulting from less than half as many stock-outs as formerly, was worth much more than the $30,000 the operations research studies cost.

The Mueller Brass Company experience in linear programing is described in "Establishing Optimum Machine Loading," by Ernest Schleusener. Their studies showed that one department had idle hours amounting to about 17 per cent. "A short time after linear programing had been introduced, this figure dropped to about 4 or 5 per cent and then, with the next stage of improvement, to about 1 percent, where it remained."

OPERATIONS RESEARCH FOR THE BUSINESSMAN

Clark Sloat, Price Waterhouse & Co., New York
THE CONTROLLER, June 1957; pages 274, 275, 305-309.

Examples of business decisions are given which show the "old" or conventional method contrasted with the "new" or scientific method found in operations research. No mathematical explanations are given in the examples. The intent of the article is to show the manager the value to be gained through using the scientific methods, in concrete figures, rather than in complicated formulas. The solutions to the

simplified problems are given in contrasting tables or graphs, along with a description of the typical problem being solved. The problems include: production line loading, warehousing from a number of plants, inventory maintenance, reserve manpower for an assembly line, waiting time (example used is tool crib line).

"The business problems which perhaps offer the best opportunities for the advantageous application of OR techniques fall generally into the following six categories: 1. Inventory, 2. Allocation, 3. Scheduling or waiting line, 4. Replacement or renewal, 5. Competitive situations, 6. Information requirements."

MATHEMATICS AND COMPUTERS

George R. Stibitz and Jules A. Larrivee
Published by McGraw-Hill, 1957.

If you have ever wondered just exactly what kind of an animal a "mathematician" is, and if you have considered computers as an enigma of the atomic age, this is your book. Written in a light and whimsical style, it takes the wizardry out of the "numbers game" without destroying the romance of mathematics. It can be a great help to those whose high school math poorly equips them for an understanding of mathematical models used in the management science techniques of operations research.

Price: $5.00

General Information

ANTICIPATING THE IMPACT OF ELECTRONIC DATA PROCESSING ON ALL LEVELS OF MANAGEMENT

Howard I. Hollander, The National Cash Register Co., Dayton, Ohio
N.A.A. BULLETIN, Section 2, July 1957; pages 1474-1489.

Future possibilities for common language techniques

Concluding a resume of the status of EDP today is a statement of opinion about the future possibilities of automatic data processing in business. The author believes that business and government should anticipate future common needs in data processing and provide for them now through "enlargement of the 'common data language'concept to embrace all business, government and industry." This includes the standardization of certain business requirements and practices as well as the establishment of common language media such as punched tape and magnetic tape. The implications of such a concept include:

1. Reduction of cost of EDP installations. Equipment manufacturers can maintain complete libraries of pre-tested programs for all types of standard business applications, as well as extensive sub-routine libraries. This will cut down programing time for the individual organizations using the equipment. Also, preliminary investigations will be minimized by establishing standard procedures in EDP and business organization.

2. Cooperative data processing centers. Such centers will be practical only if all members adopt uniform standards of data content and output requirements.

3. Use of service centers. As in the case of cooperative data processing centers, standardized procedures would be needed for service centers serving small organizations which could not otherwise have the advantage of EDP systems.

4. Integration with government agencies. With a common language medium and standardized procedures, corporate taxes could be reported directly by means of the company's own magnetic tape files, eliminating the repeated re-copying of information now being done. This procedure has already been approved in the reporting of social security taxes.

5. Vendor-vendee relations. A system for accounts payable and accounts receivable similar to the Federal Reserve

banking system is envisioned. "Once common data standards are a fact....all corporate entities would be assigned code numbers approximating the Federal Reserve numbers used by banks. Tape duplicates of the vendor's charges would be transmitted directly to regional centers, instead of to the vendee. Here, high speed electronic data processors would sort all entries by both vendor and vendee numbers. Those within the region would be directly stored and accumulated. Those outside of the region would be transmitted over a network system to the appropriate regions. Periodically each corporate entity would receive a statement from its regional center. It would be completely itemized, listing all transactions affecting both accounts receivable and accounts payable. A single settlement with each company--either remittance or disbursement depending upon conditions--would replace all of the countless millions of daily hard copy transactions presently required to accomplish this result."

BUSINESS APPLICATIONS OF COMPUTERS

B. C. Lemke, Michigan State University, Michigan
THE ACCOUNTANT, June 8, 1957; pages 676-680.

The results of a survey of European countries and Great Britain regarding the use of electronic computers for business showed that "the urgency to speed up and automate accounting and accounting-related processes does not presently exist in Europe to the degree that it apparently does in the United States. The relative economy of pre-computer methods of data processing ignoring the speed element, presumably shows up much better in Europe than in the United States. Factors such as the wage structure of the office force, the availability of acceptably trained employees, the cost of equipment, and the climate of competition as it relates to the urgency of supplying current data and improving services to customers, do not favour the adoption of the computer to the same degree as they often do in the United States."

IDEAS FOR MANAGEMENT

Published by MODERN OFFICE PROCEDURES, 1957.

The papers and case histories presented at the 9th Annual International Systems Meeting (Systems and Procedures Association) are published in a form similar to that of preceding years, except that the binding is loose leaf, and the sections are bound as separate

pamphlets, each with its own table of contents. The sections are: New Techniques for Management, Operations Within the Systems and Procedures Department, Cost Reduction Techniques, Electronic Applications and New Developments, Research Techniques, Integrated Data Processing, Industry Group and Educational Programs.

((We did not find new or unusual information in this year's edition as we have in the past, and feel that the price of $25.00 is high, especially in view of the rather careless production and proofing on the part of the publisher.))

BANK AUTOMATION

BANKING, July 1957; pages 54-57, 138, 140-141

A question and answer session at the Northern Regional Convention of the National Association of Bank Auditors and Comptrollers, held in Cleveland, produced some conjectural answers to questions about the feasibility and the availability of electronic equipment for commercial banking operations. One answer of interest to internal auditors concerned the techniques for maintaining control in an automatic system. "The complete separation of data processing from entry origination which becomes absolute with the use of electronic equipment will bring the field of audit and control to a stage of perfection never before imagined or even dreamed of."

CASE STUDIES IN RECORDS RETENTION AND CONTROL

Published by Controllership Foundation, Inc., New York.

A vital part of a successful business system is the disposition of paper--the preservation of the necessary documents, and the destruction of records with only transient value. The Controllership Foundation has prepared a study of 13 widely differing companies whose successful record retention programs are surprisingly similar. The similarity implies the existence of a set of principles in records management which any organization could successfully apply to its own records retention program. The 13 case studies described here are carefully documented with numerous illustrations and reproductions of forms and records. A summary analysis by William L. Rofes of Olin Mathieson Chemical Corporation gives a generalized statement of the corporate records retention experiences reported in the case studies. The Foundation plans to publish a companion study on "The Legal Aspects of Corporate Records Retention." Price: $7.50

Programing

A NEW TECHNIQUE OF PRODUCTION RUN CONTROL

Justin J. Yates, Consolidated Edison Co. of New York; and
Lawrence Dorf, Remington Rand Univac, New York

THE PROGRAMMER, April 1957.

The Electronic Operations Bureau at Consolidated Edison has developed a unique system for controlling its computer runs. It is an automatic system for controlling each magnetic tape used in a particular application by compiling beforehand its complete "life cycle" in the form of a specially designed magnetic tape label.

Controling operations in an EDP system

"A routine has been constructed which will compute label information for every tape used during the seven day period [of the customers' ledgers]. The data on the label will indicate every operation in which a particular magnetic tape will become involved.

"A complete label file will be maintained in the form of a Master Label Tape containing all label data, sequenced in computer operation order. This tape is to be used without modification until a change in one or several labels is dictated by some change in systems or procedure. It produces data for 1610 labels in two minutes and forty-five seconds of computer time.

"A pre-printed, continuous-form label lay-out was designed to be used in the Univac High Speed Printer. Its design allocates specific areas on the form for printing the variable control data required."

"The variable data necessary to fill in applicable captions on the label form was coded and Unityped, producing the Master Label Tape on which each blockette contains the data for one specific label. The coded routine provides for examination of each blockette, classifying it on the basis of a key digit, in one of three categories: a. used every day, b. used every seventh day, c. used once a month.

"In use, as each computer operation is completed, the applicable space on the label is initialed. If the tape is to be used on a subsequent business day, the date was printed in the space labeled 'Hold To,' followed by the run and Uniservo number. Thus, examination of the label at any point in the routine will indicate the processing completed and the remaining scheduled operations.

"The retention period is provided by adding to the processing data a constant equal to the number of days the tape is to be held. The resultant date is printed out in the block marked 'To Stock' and thereafter the tape is available as a blank."

Applications

COMPUTERIZED PRODUCTION CONTROL

FACTORY MANAGEMENT AND MAINTENANCE, July 1957, pages 84-90

((This article describes one of the first large scale, complex production control operations to be converted to EDP and therefore is considered to be particularly significant.))

Today, the IBM plant at Poughkeepsie, employing some 6000 production workers, does nearly 100% of its major production planning and control by (or with the aid of) a 705 EDPM system. The work includes preparation of material and parts requirements data, inventory control, parts and materials action notices, manufacturing planning and scheduling, follow-up, and machine tool loading.

This year, 1957, is the third year of IBM's conversion program. The first year was spent in planning. The second year involved converting a few of the production control operations to EDP, and experimenting with the system. The third year has seen the extension of the system to the bulk of IBM's production.

Production requirements are computed from 12-month schedule

Conversion was somewhat easier because IBM already had a punched card production control system in operation at Poughkeepsie. The EDPM system, however, brought the problem of errors in input data to the forefront; it is being solved by the establishment of controls--or checkpoints--at critical data-handling points.

From a 12-month overall production schedule, prepared by management, the machine determines production requirements of each specific machine type. Using monthly production schedules, customer engineering (maintenance) requirements, and miscellaneous planning requirements, the machine develops total planning requirements. Then using the bill of materials file (which has been up-dated by engineering changes), the parts and materials explosion is accomplished, to give summarized requirements for all parts and components. The machine then compares these requirements with the perpetual inventory information, and prints out action notices of parts and materials that need reordering.

The perpetual inventory file is up-dated daily by receipts and issue information (coming in on punched cards), and once a month by the new orders. Action notices are printed out when necessary, during any up-dating run. The Schedule and Load file (now on punched cards) is up-dated daily by the receipt of move tickets and by the issuing of new orders, change orders, etc.; it is used to prepare a bi-weekly machine tool load forecast.

At its Poughkeepsie plant, IBM produces 50 different types of machines involving some 40,000 active and 70,000 inactive parts and components. The production control operation for this size activity now requires about 25% of the 705's time on a two-shift basis; this figure is expected to increase to 30% in the near future. In dollars, this means that computer costs for production control now run about $12,500 monthly. Dollar savings have not been apparent, but the picture has been distorted due to the fact that the rate of 705 production shipments jumped 100% during the period of converting production control to the 705. It is estimated that the 705 has resulted in a 600-hour per month reduction in use of EAM equipment, and a reduction of 10 people in the 200-man production control department. In the future, it is expected that the manpower reduction will increase to 40.

Some of the individual computer times include: monthly updating of perpetual inventory, 2 hours; monthly inventory action reports, 2 hours; daily perpetual inventory processing, 2 to 3 hours; weekly or bi-weekly machine load forecast, 3-1/2 hours; complete requirements breakdown, 12 hours.

LITERARY DATA PROCESSING

IBM JOURNAL, July 1957; pages 249-256.

A detailed description of the punched card analysis of the works of St. Thomas Aquinas suggests the use of these methods in other literature analysis and document search. An extension of the methods is found in the use of the IBM 705 to analyze the Dead Sea Scrolls. As many as five consecutive missing words may be supplied by the machine analysis of the style and context of the work being studied. "The indexing and coding techniques developed by this method offer a comparatively fast method of literature searching, and it appears that the machine-searching application may initiate a new era of language engineering. It should certainly lead to improved and more sophisticated techniques for use in libraries, chemical documentation, and abstract preparation, as well as in literary analysis."

((See: DPD, December 1956; pages 7, 8--"IBM punched-card accounting is adapted to make scholarly indexes."))

ESSO PUTS COMPUTER TO WORK IN PROCESSING SALES STATISTICS

BUSINESS WEEK, July 13, 1957; page 57.

Esso Standard Oil Co., will use an IBM 650 in a marketing data-processing center to serve its 10 sales division headquarters. The center will be in operation in about two years.

Equipment

MAGNETIC TAPE CAN SIMPLIFY ACCOUNT DISTRIBUTION

Louis Marienthal, William Rolph, ElectroData Div., Burroughs Corp.
JOURNAL OF MACHINE ACCOUNTING, July 1957; pages 12-17.

At first computers were used for single, specific jobs. With the introduction of magnetic tape systems it is possible to add "auxiliary applications." For example, it is possible to produce "a variety of by-product statistics for account distribution purposes." Developing charges against various expense accounts while maintaining inventory records is a specific example.

DataFile is used for sales and invoicing

By using the bin-type DataFile available with the Datatron 205 computer, it is possible to accumulate account data directly. In this memory system, each group of 200 characters (a "block") has an address, which can be the account number. The computer system can search for a particular block independently of the operation of the central computer.

A brief example is given where sales data by product and by district are accumulated. Posting to these accounts is done during the regular computer run, having as its primary purpose the production of invoices and posting of accounts receivable. Information can be combined in any form. For example, a report of sales of products 9 through 70 in district 1; or a report of all sales for product 6 can be obtained.

Advantages claimed are: special reports obtainable, manual cross-totaling eliminated, special budget breakdowns available at low expense, accumulated statistics available for accountants at budget time.

((See also: DPD August 1957, page 11.))

RANDOM ACCESS TO DATA IMPROVES INFORMATION PROCESSING

AUTOMATION, July 1957; pages 71-81.

Descriptions of three types of random access systems are given: IBM RAMAC, ElectroData Datafile, and the Potter RAM. They are representative of three different concepts of the mechanics of storage.

The RAMAC is a series of discs stacked on a center shaft. The read-write heads are mounted on a vertical arm which raises

or lowers the heads to the desired disc, then moves radially to the portion of the disc to be read from or written on.

The DataFile is a bin containing 50 free-end tapes which are moved in either direction over roller feeds. The read-write heads are mounted on a travelling arm which moves horizontally to the desired tape, and searches the moving tape for the desired location.

The Potter RAM contains racks upon which the tapes are hung vertically, five abreast, 20 racks to each "page." Information is located through the selection of one of five read-write heads on each side of a "page," and by the mechanical positioning of the page to one of ten vertical positions.

"SELF-ERASING" MECHANICAL BLACKBOARD

JOURNAL OF THE FRANKLIN INSTITUTE, July 1957; pages 81, 82.

The University of Michigan's Engineering Research Institute has designed and built MITAB (Michigan Transportation and Assignment Blackboard), an electronic device resembling, in concept, the matrix used in linear programing. It was built at a cost of about $5000. The device is not a computer, since it cannot remember instructions; but it can perform arithmetic operations, under the control of an operator. In attempting to assign 20 jobs to 20 machines in a plant, for example, the 20 by 20 grid can be manipulated by the operators to find the best of 2 billion billion possible answers to the problem in minutes--which is fast even for the best electronic computers. The device is especially useful as a teaching tool, because the students can observe the effects of various mathematical changes as the problem is solved. The changes in the matrix are made as the operator spins a dial similar to that on a telephone.

HIGH SPEED COMMUNICATION AMONG DATA PROCESSING MACHINES

JOURNAL OF THE FRANKLIN INSTITUTE, July 1957; pages 80, 81

Bell Telephone Laboratories have designed an experimental device which enables business machines to communicate at a speed of about 1000 words a minute, by the sending of messages via telephone lines. The information is placed on magnetic tape by an electronic computer, electric typewriter, or other magnetic tape equipment. The tape is then inserted into the "data subset," and the person on sending end telephones the person on the receiving end that the message is about to be transmitted. An automatic signal indicates the completion of the message. The person on the receiving end then removes the tape from the receiver and inserts

it in the magnetic tape office machine for decoding. If there is a disturbance during transmission, the receiving equipment will reject the affected portion of the message and automatically cause it to be retransmitted.

NATIONAL CASH REGISTER CHEMICAL SWITCH MEMORY DEVICE

OFFICE AUTOMATION — Up-dating Service, July 15, 1957; pages 160q, 160r.

Research by NCR indicates that the possibility of a new type of switch--one which is basically chemical--will provide further advance in the computer field. The switch is an extension of the research which produced the NCR (no carbon required) paper. NCR envisions tiny capsules containing a dye coated on paper or other material. By using an extremely narrow beam of light, the material can be 'written on" in coded dots of color. A "neutral" light would then "read" the information without erasing it whenever the computer system would need to consult the memory. Another type of light would erase the information, returning the coating of capsules to its original state.

IBM 774 TAPE DATA SELECTOR HAS TWO NEW FEATURES

Two new optional features have been added to the IBM 744 Tape Data Selector: file search and additional magnetic core storage.

With the new file search feature, the 744 can rapidly locate an individual record or class of records within a file of magnetic tapes, through simple wiring changes on the control panel. The information may be printed out on the accounting machine or produced in punch card form. The 120 positions of magnetic core storage have been increased to 140 or 160, depending on the model selected.

Comment

PROBLEMS OF DATA RECOGNITION

Perfect input is required for computers

One of the most difficult problems in utilizing a computer to manipulate business data, is to program the computer so that it will recognize input data which is distorted. For example, a human can easily recognize "NE WYOK" as being "NEW YORK," especially if it is in the position usually containing an address. This recognition is possible because our language is redundant[2]; that is, it contains more information than absolutely necessary to classify an entity. A machine, as normally used, cannot take advantage of this redundancy and therefore must have absolutely perfect input data. Since humans do not produce perfect data consistently, a large percent of the data coming into a mechanized data processing center must be reviewed and corrected manually before the machines can process it.

There are two approaches to improving this situation, as exemplified by recent articles.[3, 4] One is to try to program the computer so that it can recognize distorted inputs. Glantz[3] considers this approach. Consider, for example, a "target" list of all cities in the country, and some "source" data, supposed to be cities. Two problems arise: 1) "The necessity for time-consuming exhaustiveness in the matching operation." In other words, how do we search the target list quickly and at low cost to determine if a particular source word matches one of them. 2) The other problem is that of erroneous inputs--the problem mentioned above. We might find that the source word a) does not match any target word, b) matches two or more, c) does not match any, but would if the redundancy of the data were utilized, or d) matches, but is wrong. It is conceivable that by analyzing statistically common errors in the input, errors of type c can be reduced. "Experience indicates, however, that this type of procedure will reveal only the most glaringly evident faults....It is clear that the present recognition techniques are not capable of attaining any 'near human' level of sophistication."[3] Research is required in two directions: "towards a new understanding of mental processes and...of human recognition devices....and a basic re-evaluation of the logical possibility of creating 'learning machines.'"[3]

If we can't change the machine, change the man

Since we can at present only eliminate the glaring errors in the input, another approach is needed--which seems to be that, if we cannot change the machine, let us change the human!

In other words, the human language descriptions are given codes in the form of numbers or short alphanumeric combinations which machines can handle. Redundancy can be built into the codes also.[5] For example, we assign employees numbers, customers

account numbers; we number our products and the parts that go into them, and so on.

Having coded the data for the convenience of the machine, the next step is to try to choose these codes so as to make the subsequent data processing (by human or machine) as easy as possible. Sometimes it is possible to make the account number contain some of the information to be associated with it. For example, "one digit of an account number (for bank customers) indicates whether the account is that of a large corporation."[4]

Sometimes account codes are chosen to make sorting by some particular sequence easy; e.g. for alphabetical sorting. Reference 4 concerns a particular method for choosing account numbers. If, however, it is necessary to sort the data in several different ways at various points in the processing, no one coding is efficient for all. Also, where reference must be made to the data in various ways (for example, by account number, name, size classification, product class, etc.), cross-indices are required. One comes to the conclusion in these cases that account numbers assigned at random are about as efficient as possible, especially where meaningful numbers would be lengthy. For example, a 15-digit part number for 9000 parts is redundant by 11 digits, and every card or magnetic tape that contains these numbers is wasting this space, unless the 15-digits number really saves costs at some other point in the processing.

In general, then, "since it is evident that different requirements may lead to key (i.e. code) systems with incompatible properties, a synthesis based on judicious compromise is essential."[4]

References:

1. The American College Dictionary, Random House

2. Cherry, Colin; Human Communication, Chapter 5, John Wiley & Sons, NY, 1957

3. Glantz, Herbert T.; "On the recognition of information with a digital computer," JOURNAL of ACM, Vol. 4 No. 2, April 1957, pp 178-188.

4. Oettinger, Anthony G.; "Account identification for automatic data processing," JOURNAL of ACM, Vol. 4 No. 3, July 1957, pp 245-255.

5. The classical article on redundancy codes (for binary coded systems) is: Hamming, R. W.; "Error detecting and correcting codes," Bell System Technical Journal, 29, 1950, pp 147-160. The principles stated apply to any coding system.

THE MEANINGS OF "CODING"

The word "coding" has two distinct meanings in computer terminology. One refers to the process of converting program steps into machine language. The other refers to the assignment of "arbitrarily chosen words"[1] to represent descriptions or classifications of things. In particular, account names, transaction records and file record descriptions are often "coded" for the convenience of machine processing.

WESTERN DATA PROCESSING CENTER NEWS LETTER

News of the Western Data Processing Center at the University of California at Los Angeles is being issued in a periodic newsletter. It contains information on activities in the Center, jobs being performed, courses offered, personnel appointments, and other brief news items. To receive the newsletter, write to: Western Data Processing Center, University of California, Los Angeles 24, Calif.

References

The addresses of publishers and periodicals mentioned in this issue of Data Processing Digest are listed below for your convenience in obtaining further information about the articles or books listed.

The Accountant
4 Drapers' Gardens
Throgmorton Avenue
London EC2, England

American Management Association
1515 Broadway, Times Square
New York 36, New York

Automation
Penton Building
Cleveland 13, Ohio

Banking
12 East 36th Street
New York 16, New York

Business
Mercury House
109-119 Waterloo Road
London SE1, England

Business Week
330 West 42nd Street
New York 36, New York

The Controller
Two Park Avenue
New York 16, New York

Controllership Foundation, Inc.
Two Park Avenue
New York 16, New York

Factory Management and Maintenance
330 West 42nd Street
New York 36, New York

IBM Journal of Research and Development
590 Madison Avenue
New York 22, New York

Journal of Association for Computing Machinery
Mt. Royal and Guilford Avenues
Baltimore 2, Maryland

Journal of Franklin Institute
20th and the Parkway
Philadelphia 3, Pennsylvania

Journal of Industrial Engineering
225 North Avenue, N. W.
Atlanta, Georgia

Journal of Machine Accounting
53 West Jackson Boulevard
Chicago 4, Illinois

Mc-Graw Hill Book Co., Inc.
330 West 42nd Street
New York 36, New York

Modern Office Procedures
812 Huron Road
Cleveland 15, Ohio

N. A. A. Bulletin
505 Park Avenue
New York 22, New York

Office Automation
Automation Consultants, Inc.
1450 Broadway
New York 18, New York

The Programmer
Computer Publications Dept.
Remington Rand Univac
315 Fourth Avenue
New York 10, New York

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Training

Operations Research, Special Program for Graduate Scientists and Engineers in Industry

Date: Sept. 16, 1957 to Jan. 24, 1958
Place: Case Institute of Technology
Prerequisites: Degree in Science or Engineering, knowledge of Mathematics through Differential Equations, knowledge of Introductory Statistics or Probability
Credit: Graduate credit for students able to satisfy Case's Graduate School entrance requirements
Fee: $1,000
Information and Registration: Dr. Russell L. Ackoff, Director, Operations Research Group, Case Institute of Technology, 10900 Euclid Avenue, Cleveland 6, Ohio

Records Management Course, UCLA Extension

Date: September 26, 1957 (15-week course)
Place: Los Angeles, California (University Extension, 813 S. Hill Street)
Fee: $20.00
Instructor: William Benedon, Corporate Records Management Advisor, Lockheed Aircraft Corp., Burbank, Calif.
Information: From instructor, or UCLA Extension, 813 S. Hill Street, Los Angeles, California

Machine Evaluation of Digital Computers, University of California, Los Angeles, Fall Semester

Date: Begins September 17, 1957 (12 meetings), 7-9:30 PM
Place: UCLA Campus
Fee: $20.00
Information: UCLA Extension, 10851 LeConte Ave., Los Angeles 24; BR 2-6161

Application of Digital Computers--Systems Analysis and Design, University of California, Los Angeles, Fall Semester

Date: Begins September 19, 1957 (12 meetings), 7-9:30 PM
Place: UCLA Campus
Fee and Information: see above course

Electronic Data Processing: Programming a Business Computer, University of California, Los Angeles, Fall Semester

Date: Begins September 17, 1957 (15 meetings), 7-10 PM
Place: Hillstreet Building (813 S. Hill St., L.A.)
Fee: $30.00
Information: UCLA Extension, 10851 LeConte Ave., Los Angeles 24, or 813 S. Hill Street, Los Angeles 14, California

American Management Association Workshop and Orientation Seminars

Date: September 1957 through January 1958.
Place: Courses are presented in New York, Chicago, and Cleveland, are generally each three days in length.
Subjects: Operations Research and Electronic Data Processing courses for executives.
Information: Write to: Franc M. Ricciardi, Vice President in Charge of Divisions, American Management Association, 1515 Broadway, Times Square, New York 36, N. Y.

Installing an Electronic Data Processing System (Course 20), sponsored by Canning, Sisson and Associates

Date: October 28--November 1, 1957
Place: New York (Barbizon Plaza Hotel)
Fee: $250.00
Content: This course is a logical continuation of Course 10, Electronic Data Processing for Business and Industry. It is desirable, but not required, that attendees have taken Course 10 or its equivalent. Organization, Personnel, Physical Installation, Conversion, Operation.
Information: Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, California

Electronic Data Processing for Business and Industry (Course 10), sponsored by Canning, Sisson and Associates

Date: December 2-6, 1957
Place: Chicago (Sheraton Blackstone Hotel)
Fee: $250.00
Information: Same as above course

Engineering and Management Course, University of California, Los Angeles

Date: January 27--February 6, 1958
Place: Los Angeles, California
For whom: Engineers and managers, all levels
Subjects: Operations research, electronic data processing, * management decision-making, industrial engineering, etc. Twenty-five courses in all.
Cost: $350
Information: Edward P. Coleman, Coordinator, Engineering and Management Course, College of Engineering, University of California, Los Angeles 24, California

* This course is similar in content to "Electronic Data Processing for Business and Industry."

Installing an Electronic Data Processing System (Course 20), sponsored by Canning, Sisson and Associates

Date: February 17-21, 1958
Place: Chicago (Sheraton Blackstone Hotel)
Content: See same course listed above
Fee and Information: See same course listed above

Meetings

Systems and Procedures Association, 1957 International Systems Meeting

Date: October 7-9, 1957
Place: Los Angeles, California (Statler Hotel)
Information: Leslie Matthies, General Chairman, 1957 International Systems Meeting, 629 South Hill Street, Los Angeles 14, California

The Institute of Management Sciences Annual Meeting

Date: October 17-18, 1957
Place: Detroit, Michigan (Rackham Memorial Building)
Theme: "Research and the Management Sciences"
Information: W. W. Gardner, School of Business Administration, University of Michigan, Ann Arbor, Michigan

Third Electronics Business Systems Conference sponsored by the Western Division of National Machine Accountants Association

Date: November 7, 8, 1957
Place: San Diego, California (U.S. Grant Hotel)
Information: G. M. Blakesley, Third Electronic Business Systems Conference, P. O. Box 1448, San Diego 12, California

Operations Research Society of America, National Meeting

Date: November 14, 15, 1957
Place: Pittsburgh, Pennsylvania (Penn-Sheraton Hotel)
Theme: New tools and theory, new applications, and new areas of work

Eastern Joint Computer Conference--"Computers with Deadlines to Meet"

Date: December 9-12
Place: Washington, D. C. (Sheraton Park Hotel)
Information: Malcolm B. Catlin, Council for Economic and Industry Research, Inc., Arlington 2, Virginia

Western Joint Computer Conference

Date: May 6-9, 1958
Place: Los Angeles, California (Ambassador Hotel)
Theme: Contrasts in Computers. The last day will be devoted to Reports from the Manufacturers
Information: Dr. Willis H. Ware, General Chairman, care of Rand Corp., 1700 Main Street, Santa Monica, California

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